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REPORT
OF
AN OUTBREAK OF THE HEMLOCK LOOPER
(Ellopiia fervidaria)
IN
PACIFIC COUNTY, WASHINGTON
1930

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501 Lewis Bldg.
Portland, Oregon
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The presence of a defoliated area of hemlock in Pacific County, Washington was first called to our attention by Mr. C. S. Chapman of the Weyerhaeuser Timber Company on September 25, 1930. One of their field men, Mr. F. L. Nethery had noticed, during the summer, patches of hemlock on the Nasel River with dying foliage appearing as though the forest had been swept by fire.

On November 5th, the writer accompanied by Mr. Buckhorn of this office and Mr. Nethery, visited the area and soon discovered that this damage was due to defoliation by the hemlock looper (*Ellopiia fervidaria*).

The hemlock looper has a bad reputation as a real tree-killer. During the 1919-1921 epidemic in Tillamook County, Oregon it is reported to have killed 500,000,000 board feet of fir and hemlock. Another notable epidemic occurred in 1890 in Clatsop and Tillamook Counties, Oregon during which thousands of acres of fir and hemlock were killed. Another epidemic which occurred in the Grays Harbor region left behind it what is now known as "the worm belt". Therefore there is cause for real alarm when an epidemic of this insect is found developing in a valuable timbered area.

Only one day was spent on the area, examining the portions nearest to the roads, so that the extent of the damage can, at this time, only be roughly gauged.

Location of the Area.

The present known infestation occurs in Pacific County, Washington on the Nasel and Nemah Rivers, all within Township 11 N., Range 10 W. The heaviest damage occurs in sections 2, 12, 11, 14, 22 and 23.

About 5000 acres are affected of which the more central portions are heavily defoliated. The trees on about 500 acres are hit severely enough to be conspicuous and of these about half will probably die.

Timber Affected.

The timber type in this region is for the most part a culled virgin forest with a heavy growth of hemlock, some Sitka spruce, western red cedar and very little Douglas fir. Many years ago portions of the forest were culled of the best trees and other portions have been completely cut over, and are now covered with second growth. Even now a few small operators are working in the area.

The hemlock trees average from two to three feet in diameter. The spruce are larger averaging from three to four feet. Also a few western red cedar of very large size are found in the area.

Hemlock is the tree evidently preferred by the caterpillars and trees of all ages and sizes are fed indiscriminately. Spruce is also fed upon but not to the extent that hemlock is selected. Western red cedar and the broad-leaf trees are largely avoided. No Douglas fir was encountered but the caterpillars are known to enjoy their foliage and great quantities of fir timber was destroyed in the earlier outbreaks.

The heaviest defoliation occurs in a zone less than 100 feet above sea level and from the center of this zone decreases its intensity in all directions. Much of the timber in the center of the zone will die.

Insect Responsible.

The hemlock looper (Ellopia fervidaria or E. somniaria) which is responsible for this defoliation is a member of the Geometridae or measuring worm family.

In the adult form it is a dark, grayish-yellow or buff colored moth with a wing spread of about $1\frac{1}{2}$ to $1\frac{3}{4}$ inches. The wings are crossed with two distinct dark lines bordered with lighter yellow and there is a distinct spot on each wing near the outer border. The moths emerge from their cocoons and fly during September, October and early November and lay their eggs on the needles, branches, trunks and in the moss on the trees. The eggs are smaller than the head of a pin and of a gray-green iridescent color. The winter is passed in this stage. The following spring, in May and June the eggs hatch and the caterpillars start devouring the needles. By July their inroads into the tree's foliage is very noticeable. They reach full growth by about mid-August. When full grown the caterpillars are of a light green color with dark markings and about $1\frac{1}{2}$ inches long. They are known as measuring worms or loopers on account of their very characteristic mode of travel, which consists in alternately extending the body and then arching the back to bring the rear end of the body forward. They feed on the base of the needles, cutting them off so that the steady and continuous droppings from the trees sound like rain. When all the needles are eaten on any particular branch, the caterpillars let themselves down by means of a silken thread which they manufacture and release through their mouth parts. When the caterpillars are abundant, the forest becomes one vast "spiderweb" of these larval threads. When growth is complete in August or early September the caterpillars transform to the pupa or resting stage. This transformation takes place in the moss on the trees, in crevices of the bark, or under debris on the ground. In about two weeks time the adult moth emerges from this pupa or chrysalis form, flies, mates and is ready to start the cycle all over again.

The fact that these caterpillars destroy, not only the foliage but the buds and tender shoots explains why defoliations by this insect bring about the death of the trees in such a high percentage of cases.

The outbreaks usually last for about three years, with the first year of moderate damage, the second year of heavy damage and the third year much like the first. During this period the natural enemies, most important of which are two or more species of ichneumon wasps and a dipterous fly parasite, tend to multiply enormously and gradually bring the epidemic under control. Then for long periods, 15 to 30 years, the moths are kept under control by their enemies, and only minor infestations occur.

In the present instance, as yet the natural enemies are not found in abundance, and since this is obviously the first year of the outbreak, two more years of severe damage can well be expected, with the heaviest damage occurring next year.

ECONOMIC CONSIDERATION

There are at least three courses open to the owners of timber in this infested area.

The first course is to do nothing at all and allow the outbreak to come to a natural end. This will probably occur after two more years of serious defoliation but it is impossible to say just how extensive or severe the damage will be. A survey made now will indicate about the extent of next year's defoliation, since the dead moths on pools of water and on the trees indicate the extent of the flight and egg laying of this fall. The extent of the flight area from the data which we now have is indicated on the accompanying map by the outer red circle. Next year's defoliation will occur within this zone.

After the hemlocks have been killed, they should be removed promptly if loss is to be avoided, for it is known that the wood of this tree stains badly if left in the woods after the sap has stopped circulating; and rots are also apt to develop soon.

Therefore, if nothing is done to stop the outbreak, at least some plans should be made for salvaging the timber which is and will be killed. The owners know best what areas will be worth salvaging.

The second plan is to protect the more valuable stands by means of airplane dusting. Airplane dusting as a method of controlling this insect has been quite successfully used in British Columbia on rather limited areas up to about 2,000 acres in extent. Calcium arsenate is used and spread on the trees when they are still wet with dew at the rate of about twenty pounds of dust per acre. In the Canadian work this brought about an eighty to ninety percent kill which was more than sufficient to prevent complete defoliation and consequently saved the trees. Complete eradication through the use of the poison dust is not essential since all that is required is the destruction of enough caterpillars so that the trees will not be completely denuded. The trees are able to recover from a partial defoliation, but a complete stripping of the foliage, buds and smaller twigs causes death even from one year's attack.

The cost has been around \$6.00 to \$7.00 per acre dusted. The work therefore is expensive but when it is considered that an acre of hemlock running around 20,000 board feet per acre at \$1.50 per thousand is worth \$30.00, it may be considered good business to spend \$6.00 to save it since such an expenditure would probably not have to be repeated for another fifteen years or more. In Stanley Park, British Columbia outbreaks occurred in 1914 and again in 1930. In Tillamook County, Oregon an outbreak was recorded in 1890 and another in nearby areas about thirty years later in 1919. If so desired, the dusting could be done only on the more valuable stands and the epidemic allowed to run its course in the less valuable areas.

The third possibility is to log the more heavily infested timber at once and burn the slash before the next flight period occurs. Since the affected areas is close to the Nasel River and Willapa harbor, it is very accessible to water transportation and various milling facilities, so that the problem of salvage should not be particularly difficult. The burning of the slash and even the felling of the trees with the consequent exposure and drying out of the foliage should have some beneficial effect in destroying large numbers of young caterpillars and would probably act somewhat as a control measure. The effectiveness of using the logging method would largely depend upon the proportion of the infested stand which could be logged and the slash burned between now and the flight period of the moths next September.

RECOMMENDATIONS.

This situation involves so many economic considerations, that the writer does not feel in a position to recommend any one procedure on the basis of entomological data alone. The mixed ownership of the land, the varying value of the stumpage, the cost of logging, or salvage as against airplane dusting make this more of a problem for a logging engineer than for an entomologist. A satisfactory plan can only be worked out after such engineering as well as entomological problems have been fully considered.

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